National Imagery and Mapping Agency

The

National Imagery Transmission Format Standard (NITFS)

Program Plan

13 October 1997

For SD-1 Coordination

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TBD/TBR LISTING

Page Number	TBD/TBR Listing	Description
11	TBR001	Date when NITF 2.0 Pack capability is no longer mandated for NITF 2.1/BIIF ISP compliant systems
28	TBR003	Date when USIGS ISP for 12087-5 BIIF will be registered by ISO JTC1 and approved
22	TBR004	Date when USIGS profile for Lossy JPEG will be registered by AFNOR and approved by ISO JTC1
22	TBR005	Date when USIGS profile for Lossless JPEG will be registered by AFNOR and approved by ISO JTC1
24	TBR006	Date when USIGS ISP for ISO/IEC 8632-1 CGM will be registered by ISO JTC1 and approved
14	TBR007	Date when all NITFS/BIIF Systems must be BIIF ISP compliant under the guidelines of the NITFS Certification, Test and Evaluation Plan
34	TBR008	Inclusion of JPEG Multi-component into the NITFS suite
33	TBR009	Inclusion of JPEG 2000 into the NITFS suite
35	TBR010	Mandated Convergence of RPF with NITFS/BIIF ISP
40	TBR011	Date when the NIMA document, N0105, is approved by ISMC/GSMC
11	TBR012	Define relationship of JPEG Part 4 and TR10000 in terms of ISO profile registration, approval and terminology
28	TBR013	Date when USIGS ISP for 12087-5 BIIF is recommended for Community implementation
23	TBR017	Inclusion of Paragraph on JPEG (NIMA Method 4)

CHANGE LOG

Date	Pages Affected	Mechanism

EFFECTIVITY LOG*

Number	Effective	Description
E01*	TBR007	All NITFS/BIIF Systems must be BIIF ISP compliant under the guidelines of the NITFS Certification, Test and Evaluation Plan
E02*	TBR001	Requirement to support NITF 2.0 generation no longer mandated for compliance and certification
E03*	TBR008	Inclusion of JPEG Multi-component into the NITFS suite
E04*	TBR009	Inclusion of JPEG 2000 into the NITFS suite
E05*	TBR010	Mandated Convergence of RPF with NITFS/BIIF ISP

*Effectivities will be aligned with the USIGS Architecture and NIMA Migration Plan.

1.0 PURPOSE

This document provides the strategic plan for the National Imagery Transmission Format Standards (NITFS) migration from a Department of Defense (DoD) Military Standard to a suite of commercially accepted, international standards and profiles for implementation by users, systems, and vendors within the United States Imagery and Geospatial Information System (USIGS). In addition, a summary of the technical changes made to the current baseline of NITFS as well as transition schedules are discussed. The final section provides the detailed international standards profiles, based on internationally adopted standards, that are to be implemented by NITFS systems and applications. This document provides status and direction to the use of profiles authorized, or in development for, implementation within the NITFS suite of standards. This document also provides the migration plan for the adoption and registry of International Standardized Profiles (ISP) that are developed based on International Standards.

1.1 Scope

In addition to highlighting details of the transition of the NITFS to a suite of international standards and profiles, this document focuses on: an overview of activities regarding the NITFS in the US, NATO, and international standards arena; anticipated changes in community implementation agreements and compliance test criteria; and potential impacts to current DoD and Intelligence Community (IC) NITFS users. Specifically, focus is on the NITF 2.1 standard, which was approved on 22 August 1997 by the Imagery Standards Management Committee/Geospatial Standards Management Committee (ISMC/GSMC), and its technically equivalent standard being developed with the International Organization for Standardization (ISO), to facilitate future DoD use of international standards vice military standards.

1.2 Applicability

This document is intended to be an informative aid to thos e parties planning to upgrade existing NITF 2.0 implementations and/or those implementing NITF for the first time. The NITF 2.1 standard, related standards and profiles, and certification test documents become the normative documentation for implementation. Upon the ratification of the USIGS profile of the ISO Basic Image Interchange Format (BIIF), the profile shall become the normative documentation for implementation.

1.3 Objectives

The imagery and geospatial community currently implementing the NITFS suite of military standards requires a program plan that is controlled under configuration management, the basis of which is provided here. The intent of this plan is to provide users, program managers, developers, commercial vendors, and decision makers a reliable “road map” to the construction plans for the NITFS and its successor profile under BIIF.

This document will provide a clear understanding of the changes planned for the standards, be they military standards or international standards profiles, and a schedule for configuration control on the changes. It is expected that revisions of this document will be provided to the USIGS community in intervals of six months, as necessary, so that users have enough time to assess impacts of proposed changes, as well as for program managers to budget the required changes into their program plans. Implementation of changes outlined in later versions will be based on or scheduled following the publication of each version.

2.0 REFERENCES

JIEO Plan 9000	Department of Defense and Intelligence Community Imagery Information Technology Standards Management Plan, 01 November 1995.
CJCSI 6212.01A	Compatibility, Interoperability, and Integration of Command, Control, Communications, Computers, and Intelligence Systems, 30 June 1995.
JIEO Circular 9002	Requirements Assessment and Interoperability Certification of C4I and AIS Equipment and Systems, 23 January 1995.
JIEO Circular 9008	NITFS Certification Test and Evaluation Program Plan, 30 June 1993, with Errata Sheet dated 24 July 1996.
DOD/JTA V1.0	Department of Defense Joint Technical Architecture Version 1.0, 22 August 1996.

(Requests for copies of the above policy and planning documents may be addressed to the Joint Interoperability Test Command, NITFS Test Facility, Building 57305, Fort Huachuca, AZ 85613-7020).

2.1 Military Standards and Handbooks

MIL-STD-2500A	National Imagery Transmission Format (Version 2.0) for the National Imagery Transmission Format Standard, 12 October 1994 with Notice 1, 7 February 1997. 12 October 1994 with Notice 2, 26 September 1997.
MIL-STD-2500B	National Imagery Transmission Format (Version 2.1) for the National Imagery Transmission Format Standard, 22 August 1997.
MIL-STD-188-196	Bi-Level Image Compression for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 27 June 1996.
MIL-STD-188-198A	Joint Photographic Experts Group (JPEG) Image Compression for the National Imagery Transmission Format Standard, 15 December 1993 with Notice 1, 12 October 1994 and Notice 2, 14 March 1997.

MIL-STD-188-199	Vector Quantization Decompression for the National Imagery Transmission Format Standard, 27 June 1994 with Notice 1, 27 June 1996.
MIL-STD-2301	Computer Graphics Metafile (CGM) Implementation Standard for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 12 October 1994.
MIL-STD-2045-44500	Tactical Communications Protocol 2 (TACO2) for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 29 July 1994 and Notice 2, 27 June 1996.
MIL-STD-188-197A	Adaptive Recursive Interpolated Differential Pulse Code Modulation (ARIDPCM) Compression Algorithm for the National Imagery Transmission Format Standard, 12 October 1994.
MIL-STD-2411	Raster Product Format, 5 October 1994.
MIL-STD-2411-1	Registered Data Values for Raster Product Format, 30 August 1994.
MIL-STD-2411-2	Integration of Raster Product Format Files into the National Imagery Transmission Format, 26 August 1994.
MIL-HDBK-1300A	Military Handbook for the National Imagery Transmission Format Standard (NITFS), 12 October 1994.

(Copies of the above military standards and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094).

2.2 NIMA Specifications and Publications

NUAF	NIMA United States Imagery and Geospatial System (USIGS) Architecture Framework (NUAF), Draft.
N0101-A	Geospatial Image Access Services Specification (GIAS), 22 April 1997.
N0102-A	United States Imagery and Geospatial System (USIGS) Interoperability Profile (UIP), 22 July 1997.

NUTA	NIMA USIGS Technical Architecture (NUTA), 28 October 1997.
N0106 DRAFT	NITFS Bandwidth Compression Standards and Guidelines, 13 October 1997, Draft.
N0105 DRAFT	NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan, Review Draft 4, 8 September 1997.
NPIAE	NIMA Profile for Imagery Archive Extensions (NPIAE) for the National Imagery Transmission Format Standard (NITFS), 26 September 1997.
NSDE/97	NIMA Support Data Extensions (SDE) (Version 1.2) for the National Imagery Transmission Format Standard (NITFS), 13 March 1997.
RASG-9606-001	Airborne Synthetic Aperture Radar (SAR) Support Data Extensions (SDE) for the National Imagery Transmission Format (Version 2.0) of the National Imagery Transmission Format Standard, Version 0.9, 20 May 1996.
VIMAS	Visible, Infrared, and Multispectral Airborne Sensor Support Data Extensions for the National Imagery Transmission Format (NITF) of the National Imagery Transmission Format Standard, 25 September 1997.

(Requests for copies of the above NIMA Specifications and Publications may be made to the National Imagery and Mapping Agency, Attn: NIMA/SESM, MS-D86, 4600 Sangamore Road, Bethesda, MD 20816-5003).

2.3 Standardized NATO Agreements

STANAG 4545	NATO Secondary Imagery Format (Version 1.0); Ratification Draft 1.

(Requests for copies of the above STANAG may be made to SAF/AQIJ, 1060 AF Pentagon (5D156), Washington, DC 20330-1060).

2.4 International Standards

ISO/IEC 12087-5: DIS	Information Technology; Computer graphics and image processing; Image Processing and Interchange; Functional Specification - Part 5: Basic Image Interchange Format.
ISO/IEC Directives	Procedures for the technical work of ISO/IEC JTC1 on Information Technology, Third Edition 1995.
ISO/IEC TR10000-1:1992	Information Technology - Framework and Taxonomy of International Standardized Profiles - Part 1: General principles and documentation framework, Third Edition, 1995.
ISO/IEC TR10000-2:1992	Information Technology - Framework and Taxonomy of International Standardized Profiles - Part 2: Principles and Taxonomy for OSI Profiles, Third Edition.
ISO/IEC 8632-1:1994	Information Technology - Computer Graphics Metafile for the Storage and Transfer of Picture Description Information - Part 1: Functional Specification.
ISO/IEC 8632-3:1994	Information Technology - Computer Graphics Metafile for the Storage and Transfer of Picture Description Information - Part 3: Binary Encoding.
ISO/IEC 8632:1992	Information Technology - Computer Graphics Metafile for the Storage and Transfer of Picture Description Information, AMD.1:1994 - Parts 1-4: Rules for Profiles.
ISO/IEC 10918-1:1994	Information technology - Digital Compression and Coding of Continuous-Tone Still Images: Requirements and Guidelines.
ISO/IEC 10918-2:1995	Information Technology - Digital Compression and Coding of Continuous-Tone Still Images: Compliance Testing.
ISO/IEC 10918-3:DIS	Information Technology; Digital Compression an d Coding of Continuous-Tone Still Images; Part 1: Extensions.
ISO/IEC 10918-4:DIS	Information Technology; Digital Compression and Coding of Continuous-Tone Still Images: Part 4; Registration

	Procedures for JPEG Profile, APPn Marker, and SPIFF Profile ID Marker.
ISO/IEC 9973:1994	1st Edition, Procedures for Registration of Graphical Items.
ISO/IEC 11072:1993	Information Technology - Computer Graphics - Computer Graphics Reference Model.
ISO/IEC 12087-1:1995	Information Technology - Computer Graphics and Imag e Processing - Image Processing and Interchange-- Functional specification Part 1: Common architecture for imaging.
ISO/IEC 12087-2:1994	Information Technology - Computer Graphics and Image Processing - Image Processing and Interchange-- Functional specification Part 2: Programmer's imaging kernel system application program interface.
ISO/IEC 12087-3:1995	Information Technology - Computer Graphics and Image Processing - Image Processing and Interchange-- Functional specification Part 3: Image Interchange Facility (IIF).
ITU T.4 (1993:03)	Terminal Equipment and Protocols for Telematic Services - Standardization of Group 3 Facsimile Apparatus for Document Transmission, AMD2 08/95.

(Application for copies may be addressed to the American National Standards Institute, 13th Floor, 11 West 42nd Street, New York, NY 10036).

2.5 Other References

NITFS Tag Registry	Official Register of NITFS Tagged Record Extensions, latest update as posted at http://jitc-emh.army.mil/nitf/tag_reg/mast.htm.

3.0 THE NITFS “ROADMAP”

There is an ongoing effort to develop an international standard (ISO/IEC 12087-5 BIIF) based on the past experience and capabilities of NITF. Significant interest has been displayed by other nations to adopt the basic structure and capabilities of NITF as a common format for the exchange of imagery products. For example, the North Atlantic Treaty Organization (NATO) nominated NITF as the basis for developing a parallel, yet technically identical standard for the exchange of imagery products among secondary systems; similarly, the Open Skies nations have agreed to implement the identical format for imagery exchange among their systems.

The approach is for the US, NATO, and other interested entities (e.g., medical, law enforcement, agriculture) to develop and register profiles of applicable international standards for use in acquisition and implementation. Since the suite of international standards and profiles will not be finalized simultaneously, the interim approach is to document intended usage as a military standard in the US (MIL-STD-2500B) and as a Standardization Agreement (STANAG 4545) in the NATO arena as the technically identical standard is developed within the ISO (ISO/IEC 12087-5, BIIF). This approach provides documentation suitable for acquisition purposes while the community awaits for ISO/IEC 12087-5 within the ISO process. Likewise, MIL-STD-2301, MIL-STD-188-198, and MIL-STD-188-196 will continue to serve as definitive acquisition documents until approved profiles for the ISO CGM standard, JPEG standard, and Bi-level Standard are registered internationally and their use is under some level of configuration management by the Imagery Standards Management Committee/Geospatial Standards Management committee (ISMC/GSMC) and the National Imagery and Mapping Agency (NIMA).

Table 3-1 below lists the standards that are currently specified under the NITFS umbrella, the expected international standards, and standardized profiles that will supersede various components of the NITFS suite. Significant effort has been spent to ensure that, during the transition from the suite of military standards to registered international standardized profiles (ISP), backward compatibility to legacy NITF products can be maintained. Technically, the ISPs are identical to their military standards counterparts, to assure a seamless transition for the USIGS community of users.

Table 3-1. NITFS Standards Transition

Utility	Standard	Current NITFS Specified standard	Anticipated International Standard/Profile	Effectivity of changes to existing standard	Anticipated impact to existing implementations
File Format	NITF 2.1	MIL-STD-2500B	ISO/IEC 12087-5 ISP	2d Quarter 1999	Major additions and deletions
File Format	NITF 2.0	MIL-STD-2500A	N/A	N/A	N/A
Computer Graphics	CGM	MIL-STD-2301	ISO/IEC 8632 ISP	2d Quarter 1999	Addition of new CGM features and functionality
Compression	JPEG Baseline (lossy)	MIL-STD-188-198	ISO/IEC 10918-1 profiles	4th Quarter 1998	None/minor
Compression	JPEG Lossless	N-0106/97	ISO/IEC 10918-1/4 profiles	4th Quarter 1998	New capability
Compression	Bi -level	MIL-STD-188-196	CCITT Recommendation T.4	2d Quarter 1999	None/Minor
Compression	Vector Quantization	MIL-STD-188-199	ISO/IEC 12087-5 ISP	2d Quarter 1999	None/Minor
Compression	ARID PCM	MIL-STD-188-197	N/A (See below)	N/A	N/A
Comm. Protocol	TACO2	MIL-STD-2045-44500	N/A (See below)	N/A	N/A

The Adaptive Recursive Interpolated Differential Pulse Code Modulation Image Compression (ARIDPCM), removed as a required compression for the NITF 2.1, is now only required for use with decompressing legacy files (NITF 1.1) that implement it. Hence, MIL-STD 188-197A will continue to be the authoritative standard until such time that these legacy imagery products have been converted to other accepted compression alternatives (JPEG, no compression, etc.).

The Tactical Communications Protocol 2 (TACO2) for the NITFS, MIL-STD-2045-44500, establishes the requirements to be met by systems complying with NITFS when using the TACO2 protocol. It defines the protocols and formats that make up TACO2 and addresses issues concerning functional interoperability. Additionally, it provides for TACO2 operation aspects that are not strictly related to interoperability but may affect technical performance or resistance to error. This standard has been a companion to the NITF as a result of the widespread use of NITFS in tactical environments, where communications lines have relatively low bandwidths (i.e., 2400 or 9600 baud) and where noise and interference are significant. As a result, there will continue to be a need for TACO2 implementation within NITFS, whether it be for the NITF 2.1 or BIIF ISP. In essence, the required implementation of the BIIF ISP will not impact users who need TACO2. Until a viable alternative, non-proprietary commercial or international standard is available, the MIL-STD 2045-44500 will continue to be the sole guidance for TACO2 implementation with the NITF/BIIF. The NITF community looks to communications services providers to migrate the much needed capabilities in TACO2 to the commercial/international area.

In the case of the Bi-level compression, the military standard describes the one-dimensional and two-dimensional image data compression strategy articulated in the International Telecommunication Union (ITU), International Telegraph and Telephone Consultative Committee (CCITT) Recommendation T.4, *Standardization of Group 3 Facsimile Apparatus for Document Transmission*, (Geneva, 1980, amended at Malaga-Torremolinos, 1984 and Melbourne, 1988) and establishes its application within the NITFS. Since the ITU standard provides the exact requirements for implementation of the Bi-level compression algorithm, a specific USIGS profile is not required; the ITU document itself provides the necessary technical guidance for implementing this standard.

After the desired ISO standard is approved (ie., becomes an International Standard), as expected, in December 1997 timeframe, the process to register an BIIF ISP for the NITFS community will begin. This registration and approval process can potentially take up to eighteen months through the ISO process. Following ISO approval, MIL-STD-2500B and STANAG 4545 will be replaced by an ISP of ISO/IEC 12087-5. In the meantime, every effort shall be made to keep the MIL-STD-2500B and STANAG 4545 draft documents in technical synchronization. To ease the transition of systems fielded with NITF 2.0, significant effort has been made to

posture the BIIF, NITF 2.1, and NSIF specifications such that an implementation profile of these specifications could be essentially equal to NITF 2.0 at the binary file level. This goal has been met with minor exceptions; the majority represent the requirements for international consensus on the format, as well as century identification and security/classification markings.

The significant number of legacy NITF 2.0 files, which will be maintained for some time, dictate the following strategies for the NITF 2.0 to 2.1 (and NITF to BIIF ISP) evolution:

> *There is no intent to develop and register a NITF 2.0 ISP as will be done for NITF 2.1.*
>
> *The requirement to unpack NITF 2.0 files will continue for an indefinite time; as long as there are large numbers of NITF 2.0 files in existence and required, there will be concurrent requirements to unpack 2.0 files.*
>
> *The requirement to pack NITF 2.0 files will continue for as long as there are NITF 2.0 systems that have not yet upgraded to NITF 2.1/BIIF ISP. As a result, NITF 2.1 implementations must continue to support the creation of NITF 2.0 files until TBR01 Date/Year, ensuring interoperability with systems not yet upgraded.*
>
> *The existing suite of military standards for the NITFS 2.0 will continue to be the authoritative procurement and development document for the implementation of NITF 2.0 readers.*

NITF 2.0 support by NITF 2.1 systems will be better delimited as the certification and compliance testing requirements for NITF 2.1 mature as documented in the NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan (N0105).

Table 3-2 summarizes which standards under the current NITFS suite will be registered under the ISO process, and which ones will remain under the current DoD process; see section 4 for additional details. Policies need to be detailed for applying the ISO/IEC TR10000 series of documents to the ISP registration process and relating the JPEG part 4 document to JPEG registration. Details will be provided in later editions of this plan (TBR012).

Table 3-2. Configuration Control of Standards

Current Standard	Anticipated USIGS Standard	ISO Registration Authority	CM authority for DoD/IC
NITF 2.1	ISO/IEC 12087-5 ISP and graphical items register	ISO JTC1and NIMA	NIMA, ISMC/GSMC
NITF 2.0	MIL-STD 2500A	N/A	NIMA, ISMC/GSMC
CGM	ISO/IEC 8632 ISP and graphical items register	ISO JTC1 and NIMA[A]	NIMA, ISMC/GSMC
JPEG	ISO/IEC 10918-1 profiles	ISO SC29 and AFNOR[B]	NIMA, ISMC/GSMC
Bi-level	CCITT Rec. T.4	N/A	NIMA, ISMC/GSMC
VQ	ISO/IEC 12087-5 ISP	ISO JTC1	NIMA, ISMC/GSMC
ARIDPCM	MIL-STD 188-197	N/A	NIMA, DISA, ISMC/GSMC
TACO2	MIL-STD-2045-44500	N/A	NIMA, DISA, ISMC/GSMC

Finally, Table 3-3 below provides a look at emerging standards that will be incorporated into the NITFS/BIIF suite once adopted. This list will be periodically updated, as the documents and technologies are developed. More detail on these emerging standards is provided in section 12, Emerging Standards for the NITFS/BIIF Suite.

Table 3-3. Emerging Standards for Inclusion into the NITFS

Utility	Standard	Organization developing the Standard	Planned Date for inclusion into the NITFS suite
Compression	JPEG Multi-Component	ISO/IEC JTC1, SC29/WG1	E03*
Compression	JPEG 2000	ISO/IEC JTC1, SC29/WG1	E04*

* Will be aligned with the USIGS Architecture and NIMA Migration Plan.

[A] NIMA has been designated as the authority for the registration of new graphical items within the BIIF CGM and other standards developed within SC24 of ISO; ISO JTC1 will be the registration authority for BIIF CGM ISPs .

[B] AFNOR is the proposed registration authority for profiles of the JGEG standard (ISO/IEC 10918-1); ISO/IEC 10918-4 defines the AFNOR profile registration process. Details of this relationship will be defined in the future, as well as differences in terminology (i.e., need for an ISP for BIIF, but a profile for JPEG) are made clear (TBR012).

3.1 The National Imagery Transmission Format Standard - Background

The National Imagery Transmission Format Standard (NITFS) is the collaborative result of a US Government and Industry effort to provide a common facility for exchanging imagery, imagery derived information, and associated geospatial metadata. The purpose of the NITFS is to provide a common standard for the exchange and storage of files composed of images, symbols, text, and associated data.

Technical review, community coordination, and overall planning of the NITFS have been accomplished through the NITFS Technical Board (NTB) and its ad-hoc working groups, the Format Working Group (FWG), Bandwidth Compression Working Group (BCWG), and Communications Working Group (CWG). The NTB has evolved over the years into a true consensus-based forum emphasizing cooperation and partnership between government and industry. The NTB operates under the joint authority of the (ISMC/GSMC), which is responsible for the selection and management of imagery and geospatial standards for the DoD, IC, and the overall USIGS community.

3.2 NITF 1.0 (1984 - 1990)

By 1984, the need for a standard data format became obvious to the imaging community, and a project was initiated to develop such a format. The original goal was to develop a co-standard that could be added to all of the existing systems and incorporated into new systems during their acquisition phases. The original result of this effort was version 1.0 of the NITF, which was never implemented or fielded. The NTB was officially established at this point to continue and manage the technical development, validation, certification, and integration of the format into DoD. A Defense Support Project Office (DSPO) representative was appointed to manage and co-chair the NTB. An Intelligence Communications Architecture (INCA) Project Office representative was appointed to manage validation, certification, and testing, as well as to co-chair the NTB.

3.3 NITF 1.1 (1989-1994)

Version 1.1, an improved format, was developed, validated, and proposed as the implementation baseline. The NITF Configuration Control Board (NCCB), chaired by a representative from the Office of the Assistant Secretary of Defense (OASD) for Command, Control, Communications, and Intelligence (C3I) approved Version 1.1 for general implementation in March 1989. In 1990, a certification test facility was established in the Washington, DC area, under INCA sponsorship, but was moved to the Joint Interoperability Test Center (JITC), Fort Huachuca, Arizona, in 1991 when the Defense Intelligence Agency (DIA) assumed INCA's

responsibilities. By March 1992, over thirty different system configurations had been tested as compliant with NITF version 1.1.

3.4 NITFS / NITF 2.0 (1994 - 2000)

Development of an improved version of the N ITF, intended to address problems found with previous versions, was initiated in 1988. Initially, the new version was called NITF 2.0. A key improvement was the inclusion of communications support that would enable NITF to be transmitted over tactical circuits. This communications support was provided via the definition of the Tactical Communications Protocol 2 (TACO2). Additionally, improved image compression, forward error correction, and enhanced graphics algorithms began development. In May 1989, the Chair of the Committee on Imagery Requirements and Exploitation (COMIREX) directed the adoption of the NITF as the IC standard for the transmission of secondary images. In 1991, the OSD directed that NITF be documented as a DoD Standard, and its name was changed to the National Imagery Transmission Format Standard (NITFS). The NITFS encompasses not only the NITF 2.0 file format, but also compression algorithm standards (i.e., JPEG, ARIDPCM, Bi-level, VQ), computer graphics metafile (CGM) standards, and communication protocol standards (TACO2). By 1994, the NITFS was being implemented in a variety of systems that went beyond the "secondary imagery dissemination" capability; in fact, currently, all or components of the suite of standards are or will be implemented by a variety of components within the USIGS Technical Architecture (UTA), including: primary imagery dissemination systems, Unmanned Airborne Vehicles (UAV), digital imagery and geospatial archives and libraries, and commercial satellite vendors. As of March 1997, an estimated 18 commercial vendors have developed NITF compliant systems. Additionally, approximately 13,000 software licenses have been sold by industry providing commercial products supporting NITF 2.0.

3.5 NITFS / NITF 2.1 (1997 - TBR007)

A number of factors have driven the changes made to NITF 2.0 during recent years. Among these are: the creation of the National Imagery and Mapping Agency (NIMA), the mandate for the selection and implementation of commercial/ international standards over government/military standards where possible; user requirements for improved fusion of information, whether imagery, geospatial, or other data type; and the ever increasing need to share data within and external to systems of the DoD/IC. NITF 2.1 is based on extensive coordination among NITFS users within the USIGS community, NATO and Allied Nations, as well as with commercial vendors and groups dealing with related standards and technologies. Document N0105, Appendix C, summarizes changes made to the existing NITF 2.0

baseline in support of the proposed NITF 2.1 as well as the NATO Secondary Image Format (NSIF) and BIIF standardization efforts.

The Request for Change (RFC) for NITF 2.1, which will create MIL-STD-2500B, has been reviewed by the USIGS community, and, through the NSIF and BIIF documents, NATO and ISO SC24/WG7, respectively. This large scale review has ensured that MIL-STD-2500B is technically aligned with the other two documents. In addition, the quality of the document, from the editorial and organizational perspective, has improved considerably by having a widespread review by international readers. MIL-STD-2500B was formally approved by the ISMC/GSMC on 22 August 1997.

NITFS 2.1 compliance testing (N0105) will begin formally in March 1998, although it is no expected that the majority of systems upgrade from NITF 2.0 until the October 1998 timeframe. This will provide system developers, Program Management Offices, and commercial vendors enough time to make changes to their baselines or procure new products and applications. Some commercial and government NITF users have already begun implementation of NITF 2.1. Other NITF users will require significant time to assess the impact and determination for funding the necessary changes and implementation costs. Re-validation of compliance to the standard (see Test and Evaluation) should be considered an integral part of the 2500B enhancement and implementation to all “NITF” systems and data.

It is expected that, as a result of the Year 2000 (Y2K) impact on systems and software implementing NITF 2.0 (which is not Y2K compliant), systems will begin implementation of NITF 2.1 in the October 1998 timeframe.

4.0 BASIC IMAGE INTERCHANGE FORMAT (BIIF)

4.1 Background

The Basic Image Interchange Format (BIIF), ISO/IEC 12087-5, utilizes the concept of International Standardized Profiles (ISPs) as established by ISO/IEC TR 10000-1, Third Edition, 1995-12-15. Registering an ISP is the standardized means for tailoring BIIF for use by communities of interest that have different functional scopes that suit a variety of user requirements. BIIF has many options; the use of which are constrained for implementation to achieve file exchange interoperability within a designated community of interest. A BIIF ISP allows inclusion of data types defined by external profiles (e.g., profiles of ISO/IEC 12087, registered ISO profiles external to 12087, and other approved standards documents and registered items). Finally, use of BIIF provides an additional means of extensibility through the registration of tagged and encapsulated extensions.

4.2 Current Status

A Model Profile is prescribed in a normative annex to the BIIF standard, Annex C. This Model Profile consists of a set of proforma tables that are used as templates for specifying an international standardized profile of BIIF.

By referring to the Model Profile Proforma as the starting point and simply identifying capabilities and their constraints, new profiles may be developed and nominated for registration. Although the inclusion of the Model Profile within registered profiles is not mandatory, it is a minimally conformant use of BIIF. Inclusion of the Model Profile for implementation in conjunction with other profiles promotes an increased potential for a basic level of interoperability and data portability among implementations of differing BIIF profiles. This basic level of interoperability is achieved by providing an implementation option that allows the user to limit the content of BIIF files to the constraints of the model profile.

When preparing to apply BIIF for a specific application or domain, the Model Profile, existing ISPs, and referenced content profiles (such as those for PIKS, CGM, and JPEG) should be considered for their ready capacity to meet the targeted application domain requirements. Only after a determination that existing profiles fail the domain requirements should a new ISP be drafted.

5.0 NATO SECONDARY IMAGERY FORMAT (NSIF)

5.1 Background

The NATO Air Group IV recognized in 1995 that there was a current requirement to develop an imagery format Standardization Agreement (STANAG) for imagery that had been exploited. The term normally used for this type of imagery is "secondary" and is intended to be provided from an exploitation center to operational forces. NATO Air Group IV previously developed a series of STANAGS to satisfy their primary imagery format and recording standards. The remaining STANAG to be developed was for secondary imagery.

In May 1995, the Standards Branch of the then Central Imagery Office was contacted by representatives from Rome Air Development Center and asked if CIO could provide technical expertise and advise to aid NATO in preparing a standard similar to the US NITF. Members of the CIO Standards Branch attended the first Technical Support Team (TST) meeting held in Ann Arbor, Michigan. The purpose of this meeting was to establish the Terms of Reference and the Work Plan to develop the NSIF Standardization Agreement. In addition to the United States, representatives from France, Germany, Italy, and the United Kingdom were present. Each nation had its own interest in what this new STANAG should include. The French wanted to ensure that geospatial information was included as part of the STANAG. The United Kingdom's interest was in preserving the Primary Imagery STANAG, STANAG 7023, and not to mix primary and secondary imagery formats within a single STANAG. The Germans were interested in interoperability and the possible impacts on a standard imagery ground station within NATO. The results of this meeting were significant. A detailed Work Plan and the Terms of Reference for the effort were outlined. An aggressive schedule was established with a goal to prepare the basic STANAG for ratification by October 1996. The work was to be undertaken jointly by all attendees with the US leading the TST and responsible for the basic format requirements. The French were tasked to develop the geospatial requirements based on work within the Digital Geographic Information Working Group (DGIWG), and the Germans were tasked to develop overall structure of the STANAG. The United Kingdom was tasked to concentrate on the unique characteristics of the secondary image product and ensure that the existing primary imagery format was kept separate.

The TST held meetings quarterly from May 1995 until April 1997. Each of these meetings moved the process of defining the requirements for the NSIF STANAG toward consensus. The early meetings, July and October 1995 and March 1996, were involved with the development of the resolution of major national issues concerning scope and direction of the STANAG. An agreement was achieved at the March 1996 meeting to move forward with the proposed STANAG based essentially on the NITF with major input from the DGIWG to incorporate the

geospatial requirements and procedures. After this milestone was achieved, the document began to take shape. In addition to the regularly scheduled TST meetings, NSIF Editor meetings were planned every 6 to 8 weeks to develop the document to meet the schedule for the ratification draft, 1 October 1996. Work progressed with tremendous support provided by all national bodies. By now, CIO had been incorporated into NIMA and NIMA took the lead in generating the document from rough drafts through the entire development process. The group was successful in providing a Draft Version 0.9 by 1 October 1996. There were still some technical issues that could not be resolved with the German and French delegations. At the October 1996 NATO Air Group IV meeting, the TST Leader recommended a slip in submission of the formal ratification draft until the April 1997 meeting. Air Group IV agreed to the delay, but directed the TST to develop a detailed Work Plan for a way forward following submission of the ratification draft. This Work Plan for Phase II was to include completion of all items specifically excluded from the original Work Plan for Phase I. These items included the addition of bandwidth compression, computer graphic metafiles, audio and video, and the development of an ISP of the ISO/IEC 12087-5, BIIF, to meet the requirements of NSIF.

Following the direction provided at the October 1996 Air Group IV meeting, the TST held a series of editing meetings to complete the ratification version of NSIF. The document was presented to the Air Group IV on 8 April 1997 for ratification.

5.2 Current Status

The NSIF, STANAG 4545, version 1.0, is currently being processed for ratification within the 16 nations that comprise NATO. Formal ratification is expected in mid-October 1997. There are still technical inconsistencies between NSIF and NITF 2.1. These issues will be resolved, and the two standards technically harmonized, over the November 1997 to April 1998 period. It is expected that this harmonization will force the generation of the NSIF Version 2.0 standard, as well as and RFC to the NITF 2.1 (22 August 97) baseline. However, these changes will not impact the BIIF. In addition, a technical harmonization will promote the development of a single BIIF ISP for both the US NITFS community and the NATO NSIF community.

Air Group IV has agreed to the proposed Work Plan for Phase II of NSIF. Phase II will focus its efforts on applying peripheral requirements to the basic framework such as: video/audio, data compression, CGM tailoring, and compliance and certification.

5.3 Secondary Imagery Transmission/Secondary Imagery Dissemination (SIT/SID) Technical Support Team (TST) Phase II

The first stage or phase focused the initial efforts on providing a basic capability to exchange a still frame image with graphic overlays and associated textual reports. Phase I provided a framework for the encoding of multimedia data, suitable for NATO secondary imagery exchange. The resulting product of Phase I was NATO STANAG 4545 NSIF. STANAG 4545 was developed in close liaison with: ISO/IEC SC24/WG7 BIIF, US DoD ISMC/GSMC, NATO DGIWG, and NATO Command Control & Communication Agency (NC3A). Phase II will build on the Phase I effort and provide enhancements to the basic STANAG. Phase II will include the following tasks:

- Format task - United States lead
    - development of test and certification and compliance plan similar to NIMA document N0105 DRAFT
    - coordination with ISO, NATO and US groups
    - format global oversight
    - editing documentation
- Video/Audio - United Kingdom lead (tentative)
    - encapsulating video and audio clips into NSIF framework (candidate: MPEG 1, MPEG 2)
- Bandwidth compression - Germany lead (tentative)
    - defining compression algorithms for video, imagery, and graphics (candidate: JPEG, Bi-level, VQ, and other)
- Vector - France lead (tentative)
    - tailoring CGM to meet NSIF requirements
    - investigating the adoption of geospatial based and 3D vectors (candidate: CGM, VPF)
- Generation of BIIF profile - All
    - Developing an ISP of BIIF using NSIF as the basis

5.4 Schedule

The Phase II efforts were approved on 8 April 1997. As done during Phase I, the TST will schedule quarterly meetings with Editing Meetings to be called as needed to progress the documents. A detailed plan of work and tasking schedules will be prepared in October 1997 following ratification of STANAG 4545 Version 1. More definitive information on Phase II will be provided in the next update to this document.

The development of a NATO profile will commence as soon as BIIF is approved as a Draft International Standard (DIS), currently scheduled for the end of calendar 1997. Specific profiles for each of the other tasks included in Phase II will be planned to coincide with the parallel development of similar profiles to support NITF and its ISP of BIIF.

6.0 BANDWIDTH COMPRESSION STANDARDS

The NITFS 2.0 suite of standards includes a number of bandwidth compression standards, some of which are based on ISO adopted standards:

- MIL-STD 188-198A Joint Photographic Experts Group (JPEG) Image Compression for the National Imagery Transmission Format Standard *(JPEG Lossy for NITFS)*

- MIL-STD-188-197 Adaptive Recursive Interpolated Differential Pulse Code Modulation (ARIDPCM) Compression Algorithm for the National Imagery Transmission Format Standard

- MIL-STD-188-196, Bi-Level Image Compression for the National Imagery Transmission Format Standard

- MIL-STD-188-199, Vector Quantization (VQ) Decompression for the National Imagery Transmission Format Standard

- N-0106, The Bandwidth Compression Standards and Guidelines for the National Imagery Transmission Format Standard (NITFS), 13 October 1997, DRAFT; provides additional technical information beyond the scope of this document. Information here is only provided for general overview of NITFS compression standards.

MIL-STD 2500B deletes the requirement to support ARIDPCM compressed imagery, except for archived imagery, and defines JPEG, VQ and Bi-level as the valid compression techniques. An additional compression algorithm, not currently specified within the NITFS umbrella, is Lossless JPEG. It, as in the case of the Lossy JPEG standard, is specified in ISO/IEC 10918-1. That standard defines two classes of compression: those based on the discrete cosine transforms (DCT) which are lossy, allowing substantial compression while producing a reconstructed image with high visual fidelity to the encoder's source image; and a second class of coding processes, not based on the DCT, and provided for applications requiring lossless compression.

The compression processes that will be supported in the NITF/BIIF standards, as listed above, are briefly described in the following sections. There are also a number of additional compression technologies being investigated in government and international standards fora for future, potential implementation of USIGS BIIF compliant systems, specifically JPEG-2000, JPEG-Multi-component, and Complex Data Compression activity. These are discussed in section 12.

6.1 Lossy JPEG Standard

This Standard establishes the requirements to be met by systems complying with NITFS when image data are compressed using the JPEG image compression algorithm as described in DIS 10918-1, *Digital Compression and Coding of Continuous-tone Still Images*. The requirements specified in the NITFS JPEG profile are intended to enable the interchange of 8- and 12-bit gray scale imagery and 24-bit color imagery compressed with JPEG. As part of the migration to international standards, a USIGS profile of the Lossy JPEG standard, technically identical to MIL-STD-188-198 will be developed to supersede the military standard. This profile will be registered as an approved profile of JPEG through the registration process as specified in 10918-4 (TBR004). This registration authority, currently, is the French Agency for Standardization (AFNOR). The specific proposed profile and additional information is provided in NIMA document, N0106. At this time, MIL-STD-188-198 is the appropriate standard for NITFS Lossy JPEG compression.

6.2 Lossless JPEG Standard

ISO/IEC Standard 10918-1 also defines a Lossless JPEG standard. The USIGS profile of this standard is documented as an example in ISO/IEC DIS 10918-4, and will be registered as an approved profile of JPEG through AFNOR. NIMA document, N0106, contains the profile for the Lossless JPEG standard. When this profile is formally approved by the ISO Registration Authority (TBR005) as a valid international profile, it shall supersede the profile defined in that document. There is currently no military standard defining this capability. There is also no requirement within the NITFS (NITF 2.0) that mandates the implementation of Lossless JPEG at this time.

6.3 Bi-level Compression

This standard establishes the requirements to be met by NITFS systems when image data are compressed using the Bi-level facsimile compression specified by the International Telecommunications Union (ITU) International Telegraph and Telephone Consultative Committee (CCITT) Recommendation T.4 and MIL-STD-188-161C for Group 3 facsimile devices. No attempt has been made to discuss image scanning, communication, or printing systems.

6.4 Vector Quantization (VQ) Decompression

VQ is a structuring algorithm which represents monochrome or color imagery with representative kernels from a code book. The indices of the representative

kernels replace the image data in the quantized image. This standard establishes the requirements to be met by NITFS compliant systems when image data are reconstructed from the VQ algorithm. This allows NITFS compliant systems to accept and reconstruct data that are described in a VQ scheme. The quantization method is roughly described in this standard and should not be referenced for the compression process. However, the reconstruction (or decompression) steps are fully described within this document. ISO/IEC 12087-5 BII) defines VQ in a normative annex to the standard . ISO/IEC 12087-5 BIIF defines VQ decompression in a normative annex to the standard. MIL-STD-188-199 establishes the requirements to be met by NITFS compliant systems when image data are decompressed using the VQ algorithm. This allows NITFS compliant systems to accept and decompress data that are compressed using a VQ compression scheme.

6.5 Downsample JPEG (NIMA Method 4) TBR17

7.0 COMPUTER GRAPHICS STANDARDS

Graphic data is used in the NITF to annotate imagery with two-dimensional information represented as a Computer Graphics Metafile (CGM). Examples of graphics are circles, ellipses, rectangles, arrows, lines, triangles, logos, unit designators, object designators (ships, aircraft), text, and special characters. A graphic is stored as a distinct unit in the NITF/BIIF file allowing it to be manipulated and displayed nondestructively relative to the images, and other graphics in the file. This standard does not preclude the use of n-dimensional graphics when future standards are developed.

The graphic format is CGM as described in ISO/IEC 8632-1, Information Technology - Computer Graphics Metafile for Storage and Transfer of Picture Description, 1992. The precise tailoring of the CGM standard to NITF is found in MIL-STD-2301. It is expected that an ISP for ISO/IEC 8632-1, for the USIGS / BIIF community, will replace the military standard when it is approved by the appropriate registration authority within ISO (TBR006).

8.0 TAGGED RECORD EXTENSIONS

Tagged Record Extensions are used in NITF, NSIF, and BIIF to provide implementers the flexibility to include value-added data or information about the file or the image(s) within the file. Extensions are necessary to the extent that USIGS users' requirements can be met beyond the base standard. The NITF design is sensitive to the potential uniqueness of data and requirements for application of the NITF imagery and associated metadata (i.e., mensuration, report generation, advanced data processing, etc.). Within NIMA, control and registration of proposed extensions to NITF is vested in the JITC as the Executive Agent. A complete description of all currently approved extensions is maintained on the Internet Home Page for the JITC, and is also mirrored on the NIMA/NITFS homepage.

8.1 Current Extensions (Refer to NPIAE/97)

The following are the significant sets of NITF extensions that have been defined since the inception of NITF 2.0. The philosophy has been that NITF extensions are optional for implementation; all readers of NITF files were minimally required to successfully skip past extension data when attempting to read files it could not process. Implementers of NITF 2.1 should give renewed consideration to whether their customer base would be better served if extensions were more robustly supported.

8.1.1 PIAE

The Profile for Imagery Archive Extensions (PIAEs) i s used primarily to support the automatic archival and cataloging of imagery products. Any implementation with a requirement to feed imagery files to an imagery archive/library should support these extensions.

8.1.2 National Support Data Extension (NSDE) (Refer to NSDE/97)

The National SDEs provide data necessary for full interpretation and exploitation of national imagery.

8.1.3 Airborne EO/SAR/IR SDE (Refer to RASG-9606-001)

The Airborne Electro-Optical (EO), Synthetic Aperture Radar (SAR) Multi-Spectral, and Infrared (IR) SDEs are currently in draft form. They provide data necessary for the interpretation and exploitation of imagery from airborne collectors. An enormous coordination effort has been invested in the alignment of the Airborne EO/SAR/IR SDE and the commercial imagery (see paragraph 8.1.10).

8.1.4 Geospatial support data extension (SDE) (Refer to N0101/2-A)

These SDEs have been developed in coordination with NATO and the ISO TC211 groups, as well as the DGIWG. The purpose is to extend the NITFS format so that standard geospatial metadata can be included with imagery or associated data for use by imagery and geospatial users and applications.

8.1.5 RPF (Refer to MIL-STDS 2411, 2411-1, 2411-2)

The Raster Product Format (RPF) extensions allow for a more robust interpretation and representation of several NIMA geospatial raster products (CADRG and CIB), which are produced in NITF 2.0 format.

8.1.6 DPPDB (Refer to MIL-PRF-89034)

Support for the Digital Point Positioning Data Base (DPPDB) ext ensions are essential for the proper interpretation and use of NITF formatted files produced in DPPDB products.

8.1.7 ICHIPA

As mensuration and geopositional tools proliferate within the USIGS environment and the use of NITF image chips (imagery products [chips] providing both the output product row and column data for the image as well as those data points referenced back to values for the original full image) continues to expand, the requirement for a “chipping tag” has been clearly evident. This tag provides users with the additional metadata required to mensurate on an image chip using applications such as RULER. This tag also supports the “chip of a chip” scenario.

8.1.8 History data extension

This extension will provide a legacy record of the processing functions that have been applied to the image, thus providing the user with a description of the state of the image data at any point in the image chain.

8.1.9 Mosaic tagged record extensions

Proposed tagged record extensions for mosaic imagery pro ducts are under evaluation. The purpose of these proposed tags (GHMOC, GHOPT, and GHMFB) is to allow creation of an imagery product comprised of multiple images collected at differing times and under differing conditions while preserving meaningful access to the support data from each of the original collection activities. The current approach is to list these tags as 'registered only' until such time that the concept and tag specifications have been proven. Once the specification becomes stable, the intent is to convert the tags to a 'controlled' tag registration.

8.1.10 Commercial Imagery SDE

The commercial SDEs provide data necessary for the cataloging and retrieval of imagery generated by commercial producers. It is expected that, as the SDE matures, additional data will be provided to allow for the full interpretation and exploitation of the imagery. A significant effort has been expended in the alignment of the commercial imagery SDE and the Airborne EO/SAR/IR/ SDE.

8.2 Extension Registry

The BIIF has simplified the concept and use of Tagged Record Extensions (TREs) by removing the historical separate placement area constraints for “registered extensions” and “controlled extensions” of the NITF 2.0 era. TREs may be placed in either extension area of the header or subheader.

BIIF also establishes a new paradigm of “public” and “private” extensions which is more typical of the needs in an international arena. Only public TREs need to be registered internationally. NIMA, through its agent, the JITC, will continue to maintain a registry of “private” USIGS TREs. When circumstances warrant, selected USIGS TREs may be nominated for international registration as public TREs. The identifier fields of public TREs always start with an asterisk (*) character.

Within the domain of USIGS private TREs, a distinction will still be maintained between “registered only” and “controlled” TREs for purposes of configuration management of extension data within the USIGS private domain. This distinction will be maintained based on the registry list in which the TRE identifier appears. As done in BIIF, any TRE can be placed in either the user defined extension field or extended header field of the applicable file header or segment subheader for which the TRE applies.

9.0 TRANSITION SCHEDULES

Figure 9-1 provides the tentative schedule for a ratified IS and profile for BIIF, as well as for the profiles/ISPs of the other standards defined under the NITFS suite.

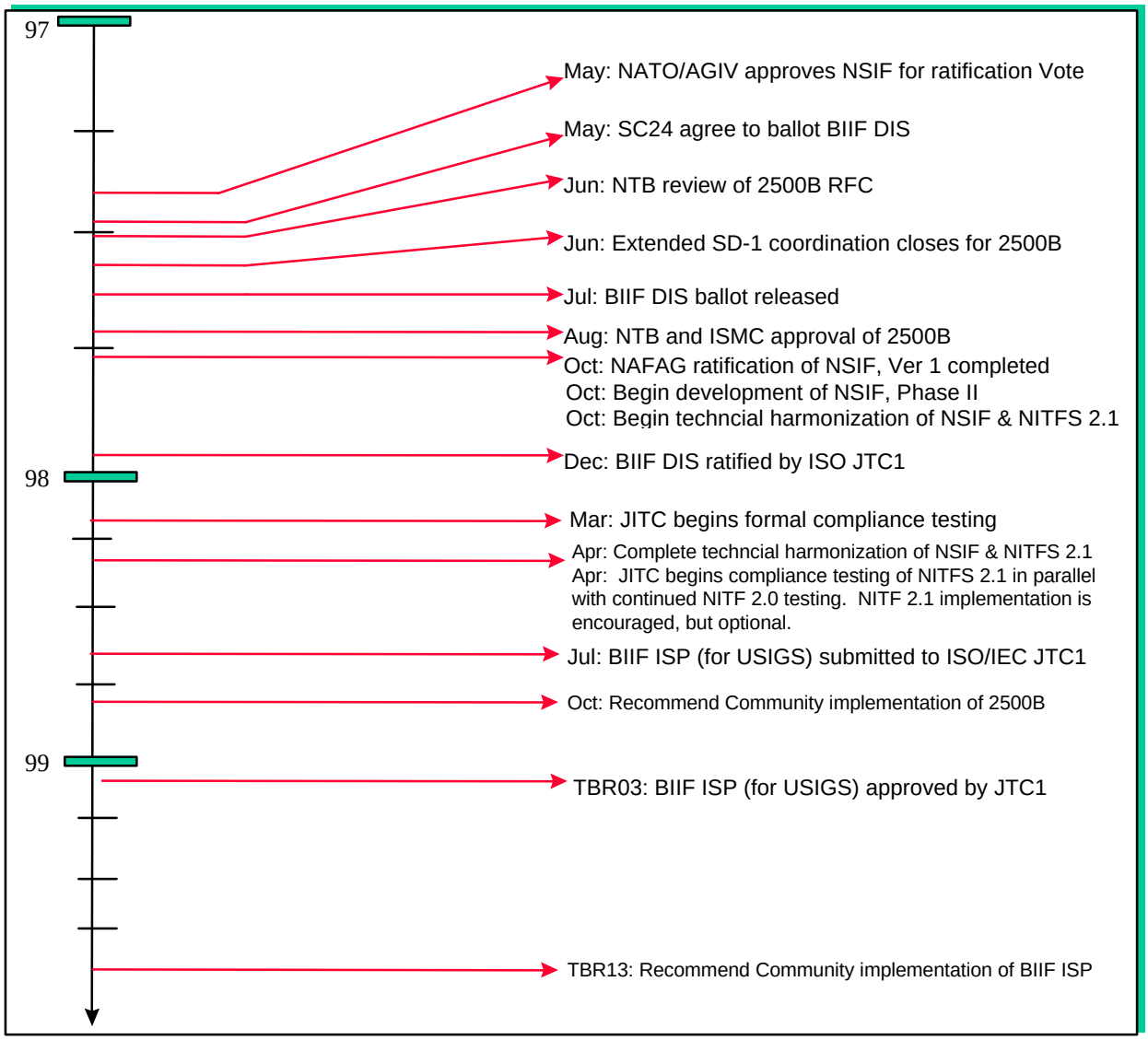

Figure 9-1. Tentative Schedule for BIIF IS and USIGS ISP of BIIF

As shown in figure 9-1, it is expected that proposed profiles for the BIIF Format, JPEG and Bi-level compression, and CGM graphics standards within the NITFS shall be developed and coordinated within the USIGS user community during the 1998 calendar year. Each of these international profiles shall have independent processes and schedules for formal approval and registration by the designated ISO/JTC1 authority. However, the profiles, as documented in the annexes of this document shall be the authority until such time that each ISP is approved. It is

expected that by Summer 1999, most of the necessary profiles will have been registered with ISO. This approach provides a consistent, configured set of profiles that are, at first, controlled under the ISMC/GSMC, and eventually under the ISO/JTC1. Configuration management, in this way, facilitates procurement and program management issue resolution as systems and/or software are updated for NITF 2.1/BIIF compliance.

10.0 CONFIGURATION MANAGEMENT OF ISO PROFILES

The following documents,

- ISO/IEC Directives: Procedures for the technical work of ISO/IEC JTC1 on Information Technology, Third Edition 1995,
- ISO/IEC TR10000-1: Information Technology - Framework and Taxonomy of International Standardized Profiles - Part 1: General principles and documentation framework, Third Edition, 1995

provide information about the ISO JTC1 role in approving, registering, and maintaining configuration management of International Standardized Profiles.

For the profiles of ISO/IEC 10918-1 JPEG, the document ISO/IEC 10918-4 defines the profile registration process.

Although ISO standards have an ISO copyright, the profiles of those standards are technically owned and controlled by the profiles' submitter. ISO does register these profiles for configuration management purposes, but does not control the technical or implementation related aspects. As is currently the case, the ISMC/GSMC shall be the controlling entity for NITFS/BIIF related profiles and standards for implementation within the DoD and IC for all components of the USIGS.

Changes to the USIGS ISP will require approval by the ISMC/GSMC, and depending on the extent of the changes, may or may not require a submission to the ISO/JTC1 authority. It needs to be noted that ISO/JTC1, as part of its approval process, determines the profiles' compliance to the standard - not how it is implemented or who implements it. Such issues will be under the realm of the ISMC/GSMC and general USIGS community.

11.0 TEST AND EVALUATION PLAN

11.1 NITF 2.0. For NITF 2.0, JIEO Circular 9008 establishes the NITFS Certification Test and Evaluation (CTE) Program for achieving and sustaining NITFS compliance by all fielded and developmental digital imagery systems. It describes the processes and procedures for obtaining certification of an imagery system for compliance with the NITFS. It also prescribes NITFS CTE Program policies, defines roles and responsibilities of participating organizations, and provides certification funding guidance.

Specifically, this document has ensured the community that developers of NITFS systems and applications implement the suite of standards in a similar way, addressing issues of ambiguity or confusion sometimes raised as standards are used.

NIMA and the JITC have drafted a new certification test and evaluation plan for NITFS 2.1, N0105 NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan. This plan describes the processes and procedures for obtaining testing of imagery implementations for compliance with the NITFS 2.1 and for interoperability among systems within the USIGS. Once the draft of the document is finalized, it will be distributed for formal SD-1 coordination and then presented to the the ISMC/GSMC for approval (TBR011).

11.2 NITF 2.1 For NITF 2.1, N0105 NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan provides the test program guidance for the implementation, test and fielding of NITF 2.1. Once NITF 2.0 only testing has concluded, N0105 will supercede JC9008.

11.3 Test Services. Developers and implementation of NITF are encouraged to contact the JITC early in their development cycle. The JITC can: 1) assist with interpreting the implementation requirements for the NITFS, 2) consult in choosing options for implementation, 3) provide sample NITF files to support development of interpret capabilities, 4) provide informal evaluation of files produced to help ensure proper understanding of the standards, and can assist with selected software list tools to assist development efforts.

The test center desires to help assure full understanding of NITFS compliance requirements early in the development cycle. They would like to avoid undue surprises at the times of formal compliance testing that may result from misinterpretation of the standards.

12.0 EMERGING STANDARDS AND ACTIVITIES

With technology evolving at an alarming rate, the expansion of the Internet and World Wide Web into areas unimaginable just a fe w years ago, and the mandate of the government to migrate to a COTS based standards environment, there is a clear need to start planning today for the standards of the future. This plan has addressed the short term future as the USIGS community transitions from the NITFS to a suite of international standards and profiles over the 1997 - 2000 timeframe. There is an understanding, however, that the long term path for BIIF needs to be clearly defined over the next few years, so that, when programmatic and procurement windows of opportunity open, the USIGS users and elements can better support the insertion of new technologies and changing standards. Incorporating this evolution requires understanding the USIGS technical architecture today, understanding the requirements of the user in the 2002+ timeframe, and clearly understanding where the commercial market is driving information interchange standards for the 21st century.

This section briefly describes a few activities that are related to the NITFS Program that may result in standards for inclusion into the BIIF suite for the future. Additional activities shall be introduced as this document evolves.

12.1 JPEG 2000 (E04)

JPEG 2000 is the title given to the follow-on to the currently defined JPEG standard, but which will most likely be a wavelet based solution. A key feature of this compression mechanism is that it will be based on a “modular” architecture framework. Modularity facilitates insertion of new technologies in the future, provides for flexibility, and facilitates the potential to “swap” modules based on compression requirements (quality, rate, etc.) of individual users.

JPEG 2000 is at “Call for Contributions” status within the ISO/IEC community, where the objective is to: gather algorithms, components of algorithms, and architectural frameworks; and to organize algorithm components into a single architecturally based standard. An architecturally based standard has the potential of allowing the JPEG 2000 standard to evolve and integrate new algorithm components without requiring a new standards definition." Once all contributions are evaluated based on an available set of criteria, actual technical development of the standard will begin.

Additional requirements of this new algorithm include:

- Improved performance (greater compression rates)
- Improved image quality

- flexibility to support different types of imagery (visible, IR, Multi-component, etc.)
- ability to support tiling, and very small and large sized imagery

The current schedule of activities for JPEG 2000 is provided below;

- Submission of algorithm contributions Sep 97
- Submission of architecture contributions Oct 97
- Second experimental results and convergence Mar 98
- Working Draft to Committee Draft (CD) Jul 98
- CD to final CD Mar 99
- Submit CD for Draft International Standard (DIS) Nov 99
- DIS submitted for International Standard (IS) Mar 00
- IS Nov 00

Profile development of the JPEG 2000 standard could potentially begin once it is accepted as a Draft International Standard (DIS). As details of the document are available, and schedules are clearly defined, this strategic plan will provide information regarding implementation into the NITFS/BIIF suite of standards (TBR009)

12.2 Multi-Component JPEG (E03)

The purpose of this Multi-component JPEG standard, under the leadership of the ISO JTC1/SC29/WG1 organization, is to provide a standard means of compressing and decompressing multiple-component, continuous tone images, in such a way that the reconstructed output has minimal image quality loss with respect to the original image. This standard would be applicable to those users who have imagery that does not subscribe well to the standard color compression techniques commonly used with the current JPEG, such as multi-spectral imagery, medical imagery (MRI, CAT scan), and color imagery.

A primary goal for this algorithm is to maintain compatibility with the procedures defined in ISO 10918-1 in order to maintain some level of backward compatibility to the current JPEG standard. There is an additional objective to develop Multi-component JPEG such that it will become part of the JPEG 2000

architectural framework, and hence avoid having two standards that can potentially support multi-spectral.

Below is the schedule for this work item;

- Submission of algorithm contributions Nov 96
- Development of WD Nov 97
- Development of CD Mar 98
- Begin Development of DIS Jul 98
- IS Adoption Nov 98

The intention is, that once the Multi-component JPEG Standard is approved as a DIS, a profile will be written such that it can be implemented by NITF/BIIF systems (TBR008). Development status will be provided in later editions of this plan.

12.3 Complex Data Compression

There are several ongoing activities in the area of complex SAR data compression that may potentially impact the NITFS/BIIF community. These involve the definition of complex data compression standard. Although not a work item in the international standards groups, the DoD/IC is actively addressing this requirement. It is however, very early in the development process, and the technology is only mature enough to provide reference information.

12.4 Emerging Container Technologies

Activities in the ISO, Object Management Group (OMG) and the Open GIS Consortium (OGC) are going to force the NITF/BIIF community to look to a new paradigm for how information (not just imagery, but video, audio, graphics, and any other data types) will be exchanged within the USIGS of the future. The evolution to distributed computing environments and new container technologies is focusing on object oriented approaches, such as the Common Request Broker Architecture (CORBA) from the OMG, Java from SUN Microsystems, and Active X from Microsoft. This is an emerging paradigm that will support the data interchange requirements and COTS technologies of the 21st Century. The DoD and IC are actively pursuing mechanisms for migrating from the current paradigm (as is now implemented by NITF/BIIF) to the paradigm that the international standards organizations and commercial consortiums are quickly heading toward.

12.5 Motion Imagery/Video Related Standards Activities

There is a great deal of interest in disseminating motion video imagery clips in the NSIF/BIIF format. Work on this requirement will commence in the Summer 1997 timeframe. It is expected that once this capability is constructed, it will be nominated into the USIGS ISP of BIIF. No further details are available at this time.

12.6 Convergence of the Raster Product Format (RPF) and NITF 2.1/BI IF ISP (E05) (TBR010)

Activities are currently underway in defining a strategy on when and how the Raster Product Format can be harmonized with the NITF 2.1/BIIF ISP. Details of this strategy, as well as assessments of impacts to existing and future production systems will be provided in the early 1998 time frame. The NIMA products impacted by this harmonization are:

- Compressed ARC Digitized Raster Graphics (CADRG)
- Controlled Image Base (CIB)
- Digital Point Positioning Data Base (DPPDB)

12.7 The Spatial Data Transfer Standard (SDTS)

Federal mapping agencies are working together toward a convergence of geospatial raster data transmission standards. SDTS Raster Profile with BIIF Extension is being drafted as a Federal Geographic Data Committee (FGDC) work item. The BIIF Geospatial ISP will incorporate the requirements of other US Federal mapping agencies. Initially the US Geological Survey (USGS) and NIMA, to allow open interoperable interchange of data by means of converging standards into a common format. Draft FGDC SDTS Raster Profile with BIIF Extension is an ISO 8211 encoding format to be used for USGS raster and gridded data, including Digital Terrain Elevation Model (DTEM).

12.8 The Digital Geographic Information Exchange Standard (DIGEST)

The DIGEST standard developed by the Digital Geographic Information Working Group (DGIWG) supports the use, exchange, and production/co-production of Digital Geographic Data. To support interoperability in NATO, DIGEST has bee promulgated and ratified as a NATO Standardization Agreement (STANAG 7074). The NATO version of NITF, NSIF, has the requirement to support georeferencing imagery. It is desirable to have a common defined georeferencing methodology within NATO. DIGEST already includes the necessary parameters for

georeferencing geospatial data and these same parameters would also apply to imagery. With that in mind the DGIWG developed a geospatial support extension to NSIF to ensure precise and correct georeferencing consistent to DIGEST. this same proposed geospatial extension is also being considered for NITF.

ANNEX A - DEFINITION OF ACRONYMS

AFNOR	French Agency for Standardization
ARIDPCM	Adaptive Recursive Interpolated Differential Pulse Code Modulation
BIIF	Basic Image Interchange Format
CADRG	Compressed ARCDigitized Raster Graphics
CCITT	International Telegraph and Telephone Consultative Committee
CD	Committee Draft
CGM	Computer Graphics Metafile
CM	Configuration Management
CORBA	Common Object Request Broker Architecture
CTE	Certification, Test, Evaluation
CWG	Communications Working Group (under NTB)
DCT	Discrete Cosine Transform
DGIWG	Digital Geographic Information Working Group
DIA	Defense Intelligence Agency
DIGEST	Digistal Geographic Information Exchange Standard
DIS	Draft International Standard
DISA	Defense Information Systems Agency
DoD	Department of Defense
DPPDB	Digital Point Positioning Data Base
DSPO	Defense Support Project Office
DTEM	Digital Terrain Elevation Model
EO	Electro-Optical

FGDC	Federal Geographic Data Committee
FWG	Format Working Group (under NTB)
GIS	Geographic Information System
IC	Intelligence Community
INCA	Intelligence Communications Architecture
IR	Infrared
IS	International Standard
ISMC/GSMC	Imagery Standards Management Committee/Geospatial Standards Management Committee
ISP	International Standardized Profile
ITU	International Telecommunications Union
JITC	Joint Interoperability Test Center
JPEG	Joint Photographic Experts Group
JTC1	Joint Technical Committee for Information Technology
MPEG	Motion Pictures Expert Group
NATO	North Atlantic Treaty Organization
NC3A	NATO Command, Control and Communications Agency
NITF	National Imagery Transmission Format
NITFS	National Imagery Transmission Format Standard
NSIF	NATO Secondary Imagery Format
NTB	NITFS Technical Board (under ISMC/GSMC)
OASD	Office of the Assistant Secretary of Defense
OGC	Open Geodata Interoperability Specification Consortium
OMG	Object Management Group
PIKS	Programmer's Imaging Kernel System

RFC	Request for Change
RPF	Raster Product Format
SAR	Synthetic Aperture Radar
SDE	Support Data Extension
SDTS	Spatial Data Transfer Standard
SIT/SID	Secondary Imagery Transmission/Secondary Imagery Dissemination
TACO2	Tactical Communications Protocol 2
TRE	Tagged Record Extension
TST	Technical Support Team
UAV	Unmanned Aerial Vehicle
UIP	USIGS Interoperability Profile
USGS	United States Geological Survey
USIGS	United States Imagery and Geospatial Information System
UTA	USIGS Technical Architecture
VPF	Vector Product Format
VQ	Vector Quantization
WD	Working Draft